



# ENERGY STAR<sup>®</sup> Program Requirements Product Specification for Room Air Conditioners

## Eligibility Criteria Draft 3 Version 3.0

1 Following is the **Draft 3 Version 3.0** ENERGY STAR Product Specification for Room Air Conditioners. A  
2 product shall meet all of the identified criteria to earn the ENERGY STAR.

3 1) **Definitions:** Below are the definitions of the relevant terms in this document. Unless otherwise  
4 specified, these definitions are consistent with the definitions in the DOE test procedure at 10 CFR  
5 430, Subpart B, Appendix F.

6 A. **Room Air Conditioner (RAC):** A consumer product, other than a “packaged terminal air  
7 conditioner,” which is powered by a single phase electric current and which is an encased  
8 assembly designed as a unit for mounting in a window or through the wall for the purpose of  
9 providing delivery of conditioned air to an enclosed space. It includes a prime source of  
10 refrigeration and may include a means for ventilating and heating.

11 a. **Casement-only:** A RAC designed for mounting in a casement window with an encased  
12 assembly with a width of 14.8 inches or less and a height of 11.2 inches or less.

13 b. **Casement-slider:** A RAC with an encased assembly designed for mounting in a sliding or  
14 casement window with a width of 15.5 inches or less.

15 c. **Reverse Cycle:** A RAC that employs a means for reversing the function of the indoor and  
16 outdoor coils such that the indoor coil becomes the refrigerating system condenser, allowing  
17 for heating of the air in the conditioned space; similarly, the outdoor coil becomes the  
18 evaporator, utilizing outdoor air as a source of heat.

19 d. **Through the Wall (TTW):** A RAC without louvered sides. These units may also be referred to  
20 as “built-in” units.

21 e. **Electromechanical:** A RAC that measures room temperature with a thermostat that  
22 undergoes a physical change (dimensional, phase change, etc.) relative to temperature, and  
23 utilizes mechanical rotary, switch, or similar user controls for cooling output, fan speed,  
24 desired temperature, or other features.

25 **Note:** In support of the revisions being proposed for the Energy Saver Mode and Filter Reminder  
26 criteria, EPA is adding a new definition for RACs with electromechanical controls. EPA was unable to  
27 identify an existing industry definition and so developed a definition of electromechanical based on  
28 stakeholder input. EPA welcomes comment on the proposed definition.

29 B. **Basic Model:** All units of a given type of product (or class thereof) manufactured by one  
30 manufacturer, having the same primary energy source, and which have essentially identical  
31 electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption,  
32 energy efficiency, water consumption, or water efficiency.

33 C. **Energy Efficiency Ratio (EER):** The ratio of cooling output (measured in BTU per hour) to  
34 electrical energy input (measured in Watts).

35 D. **Louvered Sides:** Exterior side vents on a RAC enclosure to facilitate airflow over the outdoor coil.

36 E. **Packaged Terminal Air Conditioner (PTAC):** A wall sleeve and a separate unencased  
37 combination of heating and cooling assemblies specified by the builder and intended for mounting  
38 through the wall. It includes a prime source of refrigeration, separable outdoor louvers, forced  
39 ventilation, and heating availability energy.

40 F. Portable Air Conditioner: A single package air conditioner typically mounted on wheels for the  
 41 purpose of moving the unit from place to place within a building or structure.

42 2) **Scope:**

43 A. Included Products: Products that meet the definition of a Room Air Conditioner as specified  
 44 herein are eligible for ENERGY STAR qualification, with the exception of those products listed in  
 45 Section 2.B.

46 B. Excluded Products: PTACs, portable air conditioners, and models with electric resistance heat as  
 47 the primary heat source are not eligible for ENERGY STAR qualification under this specification.  
 48 Products that are covered under other ENERGY STAR product specifications are not eligible for  
 49 qualification under this specification.

50 3) **Core Qualification Criteria:**

51 A. Energy Efficiency Ratio (EER): EER shall be greater than or equal to the Minimum EER ( $EER_{MIN}$ )  
 52 as calculated per Equation 1.

53 **Equation 1. Calculation of Minimum EER**

$$EER_{MIN} = EER_{BASE} - EER_{Adder\_Connected}$$

54 where,

55  $EER_{BASE}$  is the base EER, per Table 1, 2 or 3

56  $EER_{Adder\_Connected}$  is the EER connected allowance, per Table 4

**Table 1: Units Without Reverse Cycle**

Capacity (BTU/hour)	$EER_{BASE}$ (units with louvered sides)	$EER_{BASE}$ (units without louvered sides)
< 6,000	11.2	10.4
6,000 to 7,999		
8,000 to 10,999	11.3	9.8
11,000 to 13,999		
14,000 to 19,999		
20,000 to 27,999	9.8	
≥ 28,000		

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**Table 2: Units With Reverse Cycle**

Capacity (BTU/hour)	EER <sub>BASE</sub> (units with louvered sides)	EER <sub>BASE</sub> (units without louvered sides)
< 14,000		9.8
≥ 14,000		9.2
< 20,000	10.4	
≥ 20,000	9.8	

**Table 3: Casement Units**

Casement Type	EER <sub>BASE</sub>
Casement-Only	10.0
Casement-Slider	10.9

**Table 4: Connected Allowance<sup>1,2</sup>**

Product Type	EER <sub>Adder_Connected</sub>
All RAC types covered in Tables 1, 2 and 3	0.05 x minimum EER <sub>BASE</sub>

<sup>1</sup> Product must demonstrate “connected” functionality as specified in Section 4 and in accordance with Section 5. Note: As noted in Section 5, to use the allowance the RAC must be qualified using final and validated ENERGY STAR test method (not yet developed; see discussion in Section 5).

<sup>2</sup> Calculated allowance shall be rounded down to nearest tenth of an EER before being applied in Equation 1.

**Note:** The minimum energy efficiency ratio (EER) levels shown in Tables 1, 2 and 3 are consistent with earlier RAC Version 3.0 drafts. However, the structure of Section 3 has been revised to incorporate a “connected” allowance that EPA is proposing in Draft 3. It is envisioned that products that meet all of the final “connected” criteria -- including both consumer oriented functionality proposed in Section 4A and the demand response (DR) functionality discussed (but not yet proposed) in Section 4B of this document, and demonstrated using the future ENERGY STAR test method discussed in Section 5 -- could use an allowance equivalent to 5 percent of the product’s base EER requirement. This new proposal is reflected in Table 4 and Equation 1.

EPA intends this allowance to serve as an incentive to help jump-start the market for connected appliances, provide immediate convenience and energy savings opportunities, as well as future-oriented DR capabilities. In the meantime (prior to when the new ENERGY STAR test method is available), qualified RACs with “connected” features, as specified in Section 4, would be highlighted on the ENERGY STAR Qualified Product List (QPL).

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As an example of how this allowance would work: A traditional 8,000 BTU/hr RAC window unit would need to have an EER of at least 11.3 to qualify for ENERGY STAR under the proposed Version 3 requirements. A “connected” RAC would be eligible for an allowance of up to 0.5 EER (11.3 x 0.05, rounded down to nearest tenth) and so would need to have a minimum EER of 10.8 to qualify for ENERGY STAR. As mentioned above, products must demonstrate the DR functionality (TBD; see discussion in Section 4B) using the final and validated ENERGY STAR test method in order to use the allowance.

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B. Energy Saver Mode:

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a. Product shall have an “Energy Saver Mode,” which may be consumer override-able. In this mode, fan operation shall occur only in conjunction with compressor operation, with the following exceptions:

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i. The fan may continue to run for a period not exceeding 5 minutes after the compressor is switched off.

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ii. After the above period, when the compressor is off, the fan may be cycled on for up to 17% of the total cycle time to facilitate accurate control of room temperature. For example, the fan may run for 1 minute then cycle off for at least 5 minutes or the fan may run for 2 minutes then cycle off for at least 10 minutes. Manufacturers may use other fan run durations, but fan run time shall not exceed 17% of total cycle time.

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b. Products, excepting electromechanical RACs as defined in Section 1, shall default to “Energy Saver Mode” each time the unit is turned on.

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C. Filter Reminder:

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Products, excepting electromechanical RACs as defined in Section 1, shall have a filter reminder that provides visual notification recommending the filter be checked, cleaned or replaced, as applicable. The filter reminder may be based on operating hours, sensing technology, or other means.

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**Note:** In response to stakeholder comments, EPA has clarified the Energy Saver Mode requirement to make clear that RACs must default to “Energy Saver Mode” each time the product is turned on. This mode may be consumer override-able, but the override needs to be reset the next time the RAC is turned on with Energy Saver mode reactivated.

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In addition, EPA amended the fan cycling criterion based on manufacturer feedback that for larger units that are more likely to be placed in larger rooms, additional fan run time may be needed to accurately monitor room temperature. The maximum ratio of 1 minute fan-on to 5 minutes fan-off was retained, but additional flexibility has been added so that manufacturers may use shorter, longer or variable fan-on durations, so long as this maximum ratio is met.

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Note: EPA believes there may be some interaction between the default Energy Saver Mode and a product’s DR response (possible approaches for structuring DR criteria are discussed in Section 4). Some increase in fan use (beyond what is allowable in Section 3B, as part of Energy Saver Mode) may be desirable when the product responds to limit its energy use during a DR event. EPA recognizes the need to ensure the two sections are structured so that they are consistent with one another. To this end, EPA encourages stakeholder feedback on this as DR criteria are further considered and developed.

121 Based on stakeholder feedback that filter reminders are difficult, if not impossible, for electromechanically  
122 controlled RACs to provide, EPA has amended the Filter Reminder requirement such that it does not  
123 apply to electromechanical RACs. Similarly, EPA also amended the Energy Saver Mode requirement to  
124 clarify that electromechanical RACs are required to have an Energy Saver mode but are not required to  
125 default to Energy Saver mode each time the RAC is turned on (since electromechanical RACs use a  
126 mechanical switch to select Energy Saver mode, rather than an electronic switch).

127 D. Significant Digits and Rounding:

128 a. All calculations shall be carried out with directly measured (unrounded) values. EER shall be  
129 rounded to the nearest 0.1 Btu per watt-hour, as specified in 10 CFR 430.23(f).

130 b. Compliance with the specification limits shall be evaluated using values rounded to the  
131 nearest 0.1 Btu per watt-hour.

132 c. Directly measured or calculated values that are submitted for reporting on the ENERGY  
133 STAR website shall be rounded to the nearest significant digit as expressed in the  
134 corresponding specification limit (0.1 Btu per watt-hour) and as specified in 10 CFR 430.23(f).

135 **Note:** EPA is proposing revised language in Section 3D to reference RAC rounding procedures found in  
136 10 CFR 430.23(f) and to further harmonize with DOE regulatory requirements. To this end, the new  
137 language also specifies that compliance with the ENERGY STAR EER levels be evaluated using EER  
138 values rounded to the nearest 0.1 Btu per watt-hour.

139 E. Model Numbers: Model numbers used for ENERGY STAR qualified product submissions shall be  
140 consistent with Federal Trade Commission (FTC) and Department of Energy (DOE) submissions.

141 4) **“Connected” Product Criteria:**

142 To be eligible for the “Connected” allowance, a RAC shall have the following capabilities. The  
143 connected room air conditioner is an appliance that provides all the necessary hardware and software  
144 for communications. The product must continue to comply with the applicable product safety  
145 standards – the addition of the functionality described below shall not override existing safety  
146 protections and functions. Any reduction in load shall not adversely impact the product’s operation,  
147 e.g., at minimum, the product shall protect against extreme temperatures in the conditioned space.

148 **Note:** Consistent with the principle of enhanced consumer value and in response to the petition EPA  
149 received from a joint coalition of industry and efficiency advocates in early 2011, EPA has continued to  
150 evaluate how best to address and encourage smart grid functionality in ENERGY STAR specifications.  
151 EPA appreciates the feedback it has received from manufacturers and other industry stakeholders over  
152 the last few months. The proposed criteria in this section contain a number of changes from what had  
153 been proposed in Draft 2. Draft 3 builds closely upon the “Connected” criteria proposed by EPA in the  
154 recent Draft 1 Version 5.0 specification for residential refrigerators and freezers, which was developed  
155 with significant input from appliance manufacturers and other stakeholders.

156 EPA is proposing to refer to this bundle of demand response (DR) functionality and consumer-oriented  
157 enhancements, as “Connected.” EPA feels this better reflects the current scope of the proposed  
158 specification in Section 4 and will facilitate better consumer understanding of the near term value while  
159 supporting infrastructure that provides consumers the option of leveraging their product’s DR capabilities  
160 to save money on their energy bill is built. These additional criteria will provide consumer value through  
161 remote management and energy consumption reporting. Through interoperability with other devices and  
162 applications, consumers can enable tools that help reduce their RAC energy usage, through feedback  
163 and automation.

164 Draft 3 reflects EPA’s intention to leverage two complementary options for advancing “Connected”  
165 functionality in RACs. Products meeting all of the final criteria in Section 4 would be eligible to earn an  
166 allowance, as discussed earlier in this document, once the necessary ENERGY STAR test method is  
167 available. This allowance is intended to serve as an incentive to help jump-start the market for RACs with  
168 smart grid functionality, in recognition of the broader electric power system gains and the consumer value  
169 proposition associated with a connected appliance that can interface with an energy management  
170 system. The allowance is structured to ensure products that are eligible for this credit deliver immediate  
171 value to consumers through connected functionality such as alerts and energy consumption reporting.  
172 EPA also plans to highlight products with “connected” functionality on the ENERGY STAR QPL, so that  
173 consumers, rebate programs and other interested stakeholders can better identify and advance these  
174 products into the market.

175 The Draft 2 Version 3.0 RAC specification specified a number of minimum criteria that would need to be  
176 met for a RAC to be categorized as “Smart Grid Capable” on the QPL. Based on various comments from  
177 stakeholders, EPA has since revised the requirements for Home Energy Management (HEM)  
178 Functionality, Communication Standards, Open Access, and Information to Consumers. The proposed  
179 revisions are reflected in Sections 4A and 4C of this document. EPA welcomes comments on these  
180 proposed revisions.

181 EPA is not proposing language in Section 4B (Demand Response Functionality) in this draft. Instead,  
182 Section 4B includes a note box with discussion that frames the general goal and several potential ways in  
183 which DR criteria might be structured. EPA is seeking more feedback from stakeholders to inform the  
184 development of DR criteria that will generate grid benefit while ensuring consumers have ultimate control  
185 over their product’s response to a request to temporary curtail load. After collecting stakeholder feedback,  
186 EPA plans to issue proposed DR criteria for stakeholder review and feedback, prior to finalizing the  
187 Version 3.0 specification.

188 A. Home Energy Management (HEM) Functionality: Connectivity to Support Home Energy  
189 Management (HEM)

190 A “Connected” RAC shall have the following capabilities:

- 191 1. ~~Energy Consumption Reporting~~Representation of Energy Consumption: The product shall be  
192 capable of providing feedback on its ~~energy consumption power~~ to an energy management  
193 system or other consumer authorized device, service or application on the product or via a  
194 communication link. The data shall represent energy consumed by the ~~RAC product~~ (in watt-  
195 hours) by the product for intervals of 15 minutes or less per manufacturer specifications. in  
196 intervals of 15 minutes or less. In addition, the product may also provide energy use this  
197 feedback to the consumer on the product itself.
- 198 2. *Remote Management*: The product shall be capable of receiving and responding to consumer  
199 authorized remote requests via a communication link, similar to consumer controllable  
200 functions on the product. The product is not required to respond to remote requests that  
201 would compromise performance and/or product safety as determined by the product  
202 manufacturer.
- 203 3. *Operational Status, User Settings, and Messages*: The product shall be capable of providing  
204 the following information to an energy management system or other consumer authorized  
205 device, service or application via a communication link:
  - 206 a. User settings (e.g., temperature setpoint in °F or °C, mode of operation);
  - 207 b. Operational status (e.g., room temperature in °F or °C, fan status (on/off),  
208 compressor status (on/off))

- 210 The product shall be capable of providing the following information on the product and/or to  
211 an energy management system or other consumer authorized device, service or application  
212 via communication link:
- 213 a. At least two types of messages relevant to the energy consumption of the product.  
214 For example, alerts for room air conditioners might address: reminder to check, clean  
215 or replace filter, notification of energy consumption that is outside the product's  
216 normal range.
  - 217 b. Demand Response (DR) status (e.g., normal operation, delay load, temporary load  
218 reduction).

220 **Note:** EPA is proposing a number of consumer-oriented features a “connected” RAC must have to be  
221 eligible for the allowance. The criteria proposed in 4A have been developed with input from appliance  
222 industry stakeholders. EPA believes these enhancements support an important opportunity to empower  
223 consumers with new information and control of their appliances and energy costs. As part of a broader  
224 trend towards connected homes, appliance manufacturers are introducing communicating appliances that  
225 provide new features and services to consumers. EPA focused Section 4A upon a select bundle of  
226 features that can unlock new energy savings opportunities as well as consumer convenience. The  
227 Agency's intent is to recognize opportunities that can provide consumers with immediate value.  
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229 *Energy Consumption Reporting:* Appliances that monitor and report their energy consumption can enable  
230 increased “energy awareness” in residences. When consumers are armed with this information they are  
231 empowered to take steps to reduce their consumption. In a Cape Light Compact Pilot, customers in their  
232 Residential Smart Energy Monitoring Pilot program received access to an online energy monitoring  
233 system. This system monitored only whole-house consumption and provided an on-line dashboard that  
234 presented savings information in kWh, dollars, and CO<sub>2</sub> reduction. Despite monitoring only premises  
235 metering data, during the pilot participants reduced their home's energy consumption an average of  
236 9.3%.<sup>1</sup> The American Council for an Energy Efficient Economy (ACEEE) 2010 report, *Advanced Metering  
237 Initiatives and Residential Feedback Programs: A Meta-Review of Electricity Savings Opportunities*,  
238 surveys a variety of feedback initiatives that have reduce average household savings by 4-12%,  
239 depending on the type of feedback, with greater savings attributed to feedback that is real-time and at an  
240 appliance level.

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242 Energy consumption data from an appliance is likely to be the most meaningful to consumers when  
243 presented in concert with whole-house consumption and consumption from other principle residential  
244 loads such as lighting, hot water heating, and central air conditioning, and when it can be used to  
245 generate new insights and personalized tips on steps consumers could take to reduce energy  
246 consumption. For the purposes of this specification, requiring that connected room air conditioners report  
247 their energy consumption is essentially a small step towards the goal of reduced energy consumption  
248 through increased energy awareness. Thus, EPA considered it important to ensure that product energy  
249 consumption reporting be accomplished with minimal incremental cost. Therefore, EPA is proposing an  
250 energy reporting requirement that does not specify a minimum level of accuracy, but does require in  
251 Section 4C that the accuracy be disclosed to third-party developers. Stakeholders have indicated that  
252 estimation rather than measurement of energy consumption can provide reporting accuracy on the order  
253 of ± 10%, at a nominal incremental cost.

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255 *Remote Management:* EPA is specifying that connected RACs include remote management capabilities  
256 similar to what is controllable on the appliance itself. For example, this could include the ability to turn the  
257 RAC off during an unplanned “away” period, and return it to a comfort setting in advance of a planned  
258 “home” period. Consumer research has indicated that consumers have interest in having the ability to  
259 control lighting, appliance and thermostats with computers or mobile phones (see for example, Parks  
260 Associates 2010 Residential Energy Management Survey<sup>2</sup>). One pilot study involving demand responsive  
261 RACs found study participants valued remote access to their RACs.<sup>3</sup>  
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263 *Operational Status, User Settings and Messages:* EPA believes it is essential that consumers retain  
264 ultimate control over their appliances' operation. Connected appliances will need to provide consumers  
265 with information on the product's Demand Response (DR) status so that consumers have the option of

266 overriding a RAC's DR event. Also, notification of DR status will alert consumers that it is a DR event and  
267 not an operational issue with the RAC. For RACs, EPA has specified that RAC DR status be either  
268 provided on the interface of the product and/or reported via a communication link to a home energy  
269 management system or other consumer authorized device, service or application. EPA believes having  
270 the product's user settings and product's operational status available to HEM devices and/or applications  
271 could provide added-value for consumers. For example, an external device or application might use the  
272 user setting information together with the RAC's energy consumption being collected and reported, to  
273 provide consumers with new insights into how much energy is being used to operate the RAC at different  
274 settings and temperature set points and then message specific tips for energy and cost savings by  
275 adjusting settings. Alternatively, a device or application might leverage product data and remote  
276 management capabilities to automatically manage the RAC to generate savings thru decreased energy  
277 use.

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279 Section 4A also specifies that products provide consumers with at least two messages related to the  
280 energy consumption of the product. These could be provided either on the product or via a  
281 communication link to an external device (e.g., a consumer's smartphone, computer, or separate in-home  
282 energy display). The language provides several examples including a check filter reminder and  
283 notification of unusual energy consumption. When consumers receive a filter check notification, they  
284 could take corrective action to clean or replace the filter to help keep the product at peak operating  
285 efficiency. A message might also be designed to alert consumers (or some third party, authorized by  
286 consumers to receive this information) that the energy consumption is outside of the normal range. Upon  
287 receipt of such an alert, the consumer could take corrective action, such as de-icing, repair or  
288 replacement of a malfunctioning appliance.

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290 EPA is interested in stakeholder feedback on the proposed consumer-oriented features.

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292 <sup>1</sup> [http://www.capelightcompact.org/library/2010/08/3.31.10-Residential-Smart-Home-Energy-Monitoring-Final-](http://www.capelightcompact.org/library/2010/08/3.31.10-Residential-Smart-Home-Energy-Monitoring-Final-Evaluation-342-Report.pdf)  
293 [Evaluation-342 Report.pdf](http://www.capelightcompact.org/library/2010/08/3.31.10-Residential-Smart-Home-Energy-Monitoring-Final-Evaluation-342-Report.pdf)

294 <sup>2</sup> <http://greentechadvocates.com/2011/01/26/automation-is-appealing-to-consumers-research-firm-says/>

295 <sup>3</sup> New Approaches to Residential Demand Response, [http://www.energyefficiencymatters.org/new-approaches-to-](http://www.energyefficiencymatters.org/new-approaches-to-residential-demand-response/)  
296 [residential-demand-response/](http://www.energyefficiencymatters.org/new-approaches-to-residential-demand-response/)

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298 **A.B. Demand Response (DR) Functionality:**

299 ***TBD - See discussion below. EPA is seeking further input from stakeholders before proposing DR***  
300 ***criteria.***

302 **Note:** Air conditioning represents a large portion of the demand on the electricity grid during summer  
303 months. Once supporting infrastructure is in place, it is expected that consumers could opt to enroll  
304 products such as RACs in appliance DR programs that provide direct monetary benefits for enrollment  
305 and/or their participation in a certain number of DR events. In addition, the ability to curtail appliance  
306 loads in response to grid conditions (e.g., through price and/or DR signals that request temporary load  
307 reductions) could improve grid reliability and reduce capital investment and electricity procurement costs;  
308 those savings could benefit all consumers if they are passed on through lower rates.

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310 For example, Con Edison's Residential Smart Appliance Program is a DR program that a residential  
311 consumer can opt into, enrolling eligible appliances (including a minimum of two RACs).<sup>1</sup> Con Edison  
312 provides each enrolled consumer with a supporting home energy management system. Participants  
313 receive \$10 for each enrolled RAC and \$10 for the combination of other enrolled appliances. Consumers  
314 retain the ability to override Con Edison's adjustments to the enrolled appliances, but must agree to  
315 participate in 80 percent of event hours (on average, Con Edison notes it reduces the power to enrolled  
316 appliances 3-5 times each summer for about 6 hours per event).

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318 Based on discussions with RAC manufacturers, EPA is aware there are a number of different approaches  
319 that might be used to achieve a load reduction. These include:

- 320 - cycling off compressor and/or fan for some fraction of period;  
321 - raising the set point and thereby reducing RAC compressor and/or fan run time;

322 - utilizing variable speed technology (e.g., compressors); or  
323 - some combination thereof.

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325 For RACs, EPA anticipates such load reduction would mainly shift energy use from a critical time period  
326 to a non-critical time of the day (other products, such as lighting, are able to shed load without shifting it to  
327 another time of the day). Some end-use residential loads (like a dishwasher or clothes washer) are more  
328 discretionary and could be shifted from one time to another with little impact or inconvenience for  
329 consumers. For RACs, since many utilities' peak electricity demand tends to coincide with the hottest  
330 days of the year, RAC use is likely to be less discretionary. Therefore, the potential for load reductions  
331 from RACs need to be considered carefully to also ensure consumers' comfort is not adversely affected.  
332 Additionally, at a minimum, consumers need to be able to opt-out and override their RAC's response to a  
333 DR event.

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335 Based on the Smart Appliance petition received, further research, and conversations with stakeholders,  
336 EPA identified several possible options, discussed below, for structuring criteria for RAC DR functionality.  
337 EPA is seeking additional feedback from stakeholders on how best to structure these criteria.

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339 *Option A - Specifying a minimum set of responses that provide some reduction in energy use during the*  
340 *delay period*

341 In 2011, a joint coalition of industry and efficiency advocates submitted the Smart Appliance petition to  
342 EPA and DOE. The petition recommended definitions for two RAC-specific minimum DR capabilities,  
343 summarized below:

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345 1) A delay appliance load (DAL) capability to reduce RAC energy consumption at least 25% relative to the  
346 baseline, for a period of up to four-hours, in response to a signal from a system operator.  
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348 2) A temporary appliance load reduction (TALR) capability to reduce RAC energy use by at least 80%  
349 relative to the baseline for up to 10 minutes, in response to a signal from a system operator.

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351 For testing purposes, both DAL and TALR energy use reductions would be compared to the baseline  
352 energy use measured in the DOE RAC test method (Appendix F).

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354 Based on research and initial feedback from stakeholders, EPA has identified drawbacks and advantages  
355 with this approach. EPA's main concern is whether a load reduction that can be verified in the lab will  
356 provide a similar response in the field. As an example, consider the following test scenario and use case:

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358 - **Test Scenario:** During the DOE test, the RAC compressor runs 100% of the time. (Note: DOE test  
359 measures RAC full-load performance and specifies conditions of 80°F dry bulb (50% relative humidity)  
360 indoors, and 95°F dry bulb (and 40% relative humidity) outdoors.) Under these laboratory test  
361 conditions the RAC responds to DAL signal by reducing its energy use 25% by, in this case, running  
362 compressor 75% of the time.

363 - **Use Case:** The same RAC is installed in a small, well insulated room. On a 90°F day, the compressor  
364 runs about 50% of the time to maintain a 76°F room temperature. Under a DAL response, the  
365 compressor would need to run no more than 75% in order to comply with 25% DAL criteria. Thus,  
366 there is effectively no response by this RAC and the expected DR benefit is not delivered.

367 EPA recognizes, however, that DR events that target residential AC are most likely to occur on hot,  
368 summer afternoons; therefore, the DOE test method, which tests units at maximum capacity (100% run  
369 time), may be a reasonable proxy of real-world conditions during such DR events. However, emergency  
370 DR events may also be triggered by a failure or constraints in generation, transmission, or distribution, in  
371 which case the need for load curtailment may be independent of the outdoor temperature. EPA  
372 encourages stakeholders to share data on typical loading of the installed base of RACs during high  
373 summer peak demand.

374

375 On the other hand, EPA notes there are also several advantages to Option A. Since the responses are  
376 expressed in terms of a percent reduction, this pathway will likely provide manufacturers with the most  
377 flexibility to decide how best to achieve these reductions. Incentives could be created and tied to higher  
378 levels of reduction, encouraging innovation and development of products that exceed these minimum  
379 capabilities.

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382 Option B - Specifying a minimum set of product-specific responses (e.g., set point offset)

383 Rather than specifying a DAL response in terms of a reduction in energy use, criteria could be structured  
384 to specify that a RAC respond to a signal by increasing the set point by a specified offset. This option  
385 closely parallels the California Title 24 Upgradeable Communication Thermostat effort.<sup>2</sup> In the proposed  
386 Upgradeable Setback Thermostat (UST) specification, the UST ships with a default DR cooling offset of  
387 +4°F. However, the UST enables consumers to modify the default DR offset either upwards or  
388 downwards, but not less than 0°F. A similar approach of adjusting the temperature set point was used in  
389 a Con Edison RAC pilot where in response to a signal, the RAC was cycled at 80°F for the duration of the  
390 DR event.

391  
392 Similarly, a default TALR response could specify the compressor not run during the 10 minute reduced  
393 load period. Since most of the energy use by a RAC is from the compressor operation, this approach  
394 would likely achieve a similar end-result to the TALR capability discussed in Option A.

395  
396 One drawback with Option B is the prescriptive nature of the minimum default DR responses. In addition,  
397 there is not a current test method specifying setup and test conditions. Lastly, since the response  
398 specifies only a set point change, it does not provide any predictive information on the resultant load  
399 reduction. However, responses to DR requests may be quantified and analyzed using Advanced Metering  
400 Infrastructure (AMI).

401  
402 Option B does not provide information on the associated reduction in energy use during the delay period.  
403 Option A provides some information on the anticipated load reduction in the lab, but as discussed above,  
404 a similar reduction in load may not be provided in the field. For either approach, changes to a home's load  
405 may be measured using AMI.

406  
407 Option B may provide a better guarantee over the product's response in differing real-world conditions. It  
408 may also prove to be easier and less burdensome for manufacturers to test and verify. Further, this option  
409 may be more acceptable to consumers since the minimum DAL response is bounded by some specific  
410 temperature offset. Under both Options A and B, the RAC response could be adjusted by a consumer  
411 (e.g., Option A: consumers could set a max temperature that once reached, would override the RAC's  
412 response to the signal; Option B: consumers could adjust the temperature offset to vary their level of  
413 participation).

414  
415 Other approaches

416 In response to the Draft 1 V5.0 ENERGY STAR specification for refrigerators and freezers (released in  
417 November 2011), EPA received comments from the Electric Research Power Institute (EPRI) on the  
418 proposed DR functionality for refrigerators and freezers. EPRI noted that in some regions of the country,  
419 the two defined capabilities that were proposed [for refrigerators/freezers] may have little or no value,  
420 whereas other services may have significant value. Due to this, EPRI suggested EPA avoid trying to  
421 predict the specific services that will be needed and instead consider an approach focused on  
422 successfully informing devices of grid condition, rather than their particular response. To this end, EPRI  
423 suggesting the following definition: "A device capable of receiving information from the grid (e.g. price,  
424 events) and responding to this information according to the preferences and configuration of the  
425 consumer."

426  
427 While recognizing that the needs of the grid vary by across different regions of the country (and will  
428 change over time), EPA also believes it is appropriate that specification contain some minimum level of  
429 response to a DR request to ensure products can not only receive a signal but that the grid can also  
430 count on a number of products being able to respond. EPA is seeking feedback from stakeholders on the

431 definition proposed by EPRI and how the suggested approach of informing devices of grid conditions  
432 could be integrated in an ENERGY STAR specification. For example, a broader definition such as the one  
433 EPRI recommended, might be integrated along with a minimum set of capabilities (e.g., via Option A or  
434 Option B).

435  
436 EPA encourages stakeholder feedback on the potential RAC DR strategies discussed in this section.  
437

#### 438 Additional considerations

439 EPA also wants to ensure that the minimum DR response specified for RACs is acceptable for  
440 consumers. In other words, the response should not lead to extreme temperature conditions that cause  
441 most consumers to routinely override the function or opt-out of a DR program, thereby negating the  
442 potential DR benefits and potentially leading to a less positive experience with the product. EPA is still  
443 looking for feedback in terms of how a response (e.g., 25% reduction in energy consumption for 4-hours)  
444 would affect the room temperature. EPA is also seeking feedback on whether Option A would need to  
445 include an automatic override (e.g., if room temperature exceeds a fixed temperature threshold, such as  
446 82°F), and if so, at what temperature that override should be enabled.  
447

448 EPA is interested in stakeholder feedback on the different options for structuring a minimum set of DR  
449 functionalities, discussed above, as well as any additional approaches that should be considered.  
450

451 <sup>1</sup> See: <https://conedsmartappliance.com/faq.php> and

452 <https://conedsmartappliance.com/images/gettingstartedguide.pdf>

453 <sup>2</sup> For more information, see: [http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/2011-06-09\\_workshop/presentations/Upgradeable\\_Setback\\_Thermostats.pdf](http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/2011-06-09_workshop/presentations/Upgradeable_Setback_Thermostats.pdf)  
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### 455 C. Communication Standards, Open Access, and Information to Consumers

456 A “Connected” RAC shall meet the following criteria:

- 457 1. *DR Communication Standards*: For functionality specified in Section B, the product shall use  
458 standards identified by the National Institute of Standards and Technology (NIST) Smart Grid  
459 Interoperability Panel.<sup>1</sup>  
460
- 461 2. ~~HEM Communication Standards and Open Access~~: For functionality specified in Section A,  
462 documentation shall be made available to 3<sup>rd</sup> party developers regarding the accuracy of the  
463 representation of the energy consumption ~~energy power consumption feedback~~ reporting and  
464 ~~to allow transmission~~, reception, and interpretation of the following information:  
465
- 466 • ~~Energy Consumption Reporting~~ Representation of Energy Consumption: Power Feedback  
467 Reporting: As per Home Area Network (HAN) standards identified by the National  
468 Institute of Standards and Technology (NIST) Smart Grid Interoperability Panel
  - 469 • Remote Management: As per Home Area Network (HAN) standards identified by the  
470 National Institute of Standards and Technology (NIST) Smart Grid Interoperability Panel.  
471 The products is not required to respond to remote requests that would compromise  
472 performance and/or product safety as determined by the product manufacturer.
  - 473 • Operational Status, User Settings and Messages (if provided to consumers via a  
474 communication link): As per Home Area Network (HAN) standards identified by the  
475 National Institute of Standards and Technology (NIST) Smart Grid Interoperability Panel

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<sup>1</sup> [http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog\\_of\\_Standards\\_Processes](http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes)

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**Note:** For DR functionally, EPA is specifying that connected appliance communications use NIST Smart Grid Interoperability Panel (SGIP) identified standards to help ensure robust security and interoperability. For HEM communications, EPA's intent is to help drive open standards, interoperability, and 3<sup>rd</sup> party access, enabling consumers to leverage innovative energy management applications. SGIP identified standards may also be used for HEM communications, but use of other communication standards is also permitted. While not mandated, EPA encourages the development of common appliance control command sets and use of open standards for HEM communications.

EPA is interested in stakeholder feedback on Section 4C. In particular, does the proposed language deliver on the goals of encouraging open standards, interoperability and 3<sup>rd</sup> party access? Is there additional specificity (either in this or future specification revisions) that EPA should consider to help drive enhanced interoperability for HEM functionality?

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3. *Information to Consumers:* If additional modules, devices and/or infrastructure are part of the configuration required to activate the product's communications capabilities specified in Section B, prominent labels or other forms of consumer notifications with instructions shall be displayed at the point of purchase and in the product literature. These shall provide specific information on what consumers must do to activate these capabilities (e.g. "*This product requires installation of a manufacturer provided external network module to enable interconnection with the Smart Grid, Energy Management System, and/or with other external devices, systems or applications.*").
- If the product requires installation of one or more communication modules to enable communications specified in B, these modules must be easily user installable and shall either ship with the product or be provided to consumers by the manufacturer or a manufacturers' authorized representative, in a reasonable amount of time at no additional cost to the consumer.

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**Note:** So that consumers have the information needed to take full advantage of these connected functionalities, Section 4C(3) specifies that information be provided by manufacturers at the point of purchase and in product literature, informing consumers what additional modules, devices and/or infrastructure is necessary to activate the product’s communication capabilities. In addition, EPA has specified that if the product requires the installation of one or more communication modules to deliver the functionality specified in 4B, that the module either ship with the product or be provided to consumers in a reasonable amount of time, by the manufacturer. EPA has allowed this second option, acknowledging the relevant standards (e.g., Smart Energy Profile 2.0) are currently in development and it may be advantageous for manufacturers to provide a mail-in form so consumers receive the module, when available, at no additional cost. In addition, EPA specifies that these modules be easily installable by a consumer.

512 **5) Test Requirements:**

- 513 A. One of the following sampling plans shall be used to test energy performance for qualification to
- 514 ENERGY STAR:
  - 515 a. A representative unit shall be selected for testing based on the definition for Basic Model
  - 516 provided in Section 1. above; or
  - 517 b. Units shall be selected for EER testing per the sampling requirements defined in 10 CFR
  - 518 429.15.
- 519 B. When testing energy efficiency of room air conditioners, the following test method shall be used
- 520 to determine ENERGY STAR qualification:

521 **Table 5: Test Methods for ENERGY STAR Qualification**

ENERGY STAR Requirement	Test Method Reference
EER	10 CFR 430, Subpart B, Appendix F

- 522 C. Compliance with Energy Saver Mode and Filter Reminder criteria shall be through examination of
- 523 product and/or product documentation.
- 524 D. Compliance with Connected functionality, as specified in Section 4, shall be through examination
- 525 of product and/or product documentation. In addition, demand response functionality (still in
- 526 development) shall be certified using the *TBD* ENERGY STAR test method in order to be eligible
- 527 for the 5% allowance.

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**Note:** In order to be eligible for the 5% allowance, a RAC must have the DR functionality of its connected features certified using the still-to-be developed ENERGY STAR test method. The remaining features will be certified based on examination of product and/or product documentation. EPA and DOE are also aware that the Associated of Home Appliance Manufacturers (AHAM) has begun work to develop a new test procedure for RAC DR functionality. DOE’s efforts to develop the ENERGY STAR test method have been delayed due to the lack of RACs currently available with “connected” functionality. DOE believes it will be most productive for its test procedure development effort if manufacturers and DOE could work together on conducting investigative testing on prototypes as they may become available.

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537 6) **Effective Date:** The ENERGY STAR Room Air Conditioner specification shall take effect on January  
538 30, 2013. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR  
539 specification in effect on the model's date of manufacture. The date of manufacture is specific to each  
540 unit and is the date (e.g., month and year) on which a unit is considered to be completely assembled.

541 **Note:** EPA anticipates completing the Version 3.0 revision in Spring 2012. Due to this updated schedule,  
542 EPA has revised the effective date accordingly, to January 30, 2013.

543 7) **Future Specification Revisions:** EPA reserves the right to change the criteria should technological  
544 and/or market changes affect its usefulness to consumers, industry or the environment. In keeping  
545 with current policy, revisions to the specification are arrived at through industry discussions. In the  
546 event of a specification revision, please note that ENERGY STAR qualification is not automatically  
547 granted for the life of a product model.  
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